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Intervalley mixing and skew scattering in graphene systems[1]
MAHMOUD M. ASMAR, SERGIO E. ULLOA, Ohio University — The scattering of electrons in graphene from impurities that preserve the point symmetries of the lattice is known to be anisotropic, with a transport to elastic time ratio $\xi = 2$ at low energies [1]. In systems in which the spin orbit interactions (SOI) are locally enhanced and do not lead to K-K$'$ intervalley mixing, we have shown that the scattering becomes isotropic, and can be experimentally detected through the drop in $\xi \simeq 1$ at low carrier concentrations [2]. These systems have been also shown to exhibit skew scattering and associated spin Hall Effect (SHE) [3]. In this study we extend our analysis to defects described by time reversal invariant interactions (TRIs) that reduce the lattice symmetries of graphene and may cause intervalley scattering. We show that the presence of such defects also leads to the suppression of ξ, with carrier concentration dependence similar to those produced by the intrinsic SOI, but qualitatively different from the effects of Rashba SOI, allowing their simultaneous determination. Finally, we show the effects of such defects on skew scattering, and the dependence of the SH angle on the relative strength of such disorder.

[1] Monteverde et al.,PRL 104, 126801(2010)
[2] Asmar and Ulloa, PRL 112, 136602(2014)
[3] Ferreira et al.,PRL 112, 066601(2014)

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